Lesson 20 Part 1: Introduction **Solving Inequalities**

CCLS 6.EE.B.5 6.EE.B.8

You've learned how to replace values for variables into equations to see if they are true. Take a look at this problem.

A grocery store is giving a reusable bag to every person who donates more than \$5 to charity. Let *x* equal the amount that a person donates. Use words and symbols to solve all of the following problems about this situation.

Q	Explore	lt
(°		-

Use the math you already know to solve these prol

	Ella donates \$5.50. Will she get a bag? Explain how you know.
	Daniel donates \$5. Will he get a bag? Explain how you know.
	Courtney donates \$1.25. Will she get a bag? Explain how you know.
	Name 2 other amounts people could contribute and get a bag.
	To get a bag, are the amounts greater than or less than \$5?
	Use the symbols $>$ or $<$ to show x is greater than \$5.
•	Explain how you know when any person should receive a free bag.



Q Find Out More

A sentence such as x > 5 is called an **inequality**. On the previous page you identified values for x that make x > 5 true, like 5.50 or 10, but there are too many possible values for x to be counted. Unlike the equations we've seen that have one solution, an inequality may have infinitely many solutions.

Here are some symbols and words to describe an inequality:

>	≥	<	≤
 is more than is greater than is above	is greater than or equal tois at leastis no less thanminimum	• is less than • is below	 is less than or equal to is at most is no more than is no greater than maximum
x is greater than 5	x is at least 5	x is below 5	x is at most 5
x > 5	<i>x</i> ≥ 5	x < 5	<i>x</i> ≤ 5

Reflect

1	1 Explain the difference between an equation, like $x = 5$, and an inequality, like $x \ge 5$.					

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Read the problem below. Then explore how to write and solve an inequality.

When the temperature drops below 15°C in a building, the furnace turns on. At what temperatures will the heater turn on? Write an inequality to represent this situation, and graph the solution on a number line.

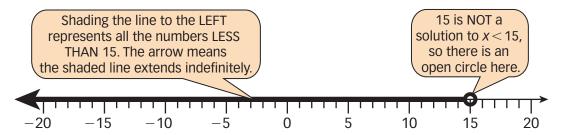
् Model It

You can use words and symbols to represent the problem.

Let x equal the temperature in a building. When x is less than 15, the heater turns on.

Q Graph It

You can graph the inequality on a number line to show all solutions.



A closed or shaded circle on the above graph would show the solutions for $x \le 15$.

्र Check It

You can substitute values for x to check your solution.

The graph shows that -5° C is a possible solution. You can replace x with -5 to check.

$$-5 < 15$$
 TRUE

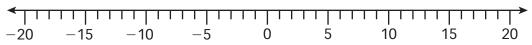
The graph shows that 16°C is not a solution. You can replace x with 16 to check.



Connect It

Now you will solve the problem using the model and graph.

- What words in the problem help you know which inequality symbol to use?
- Look at the graph. Why is there an open circle at 15? What does it mean?
- Explain the meaning of the shaded line and arrow to the left of 15.
- 5 Would the heater turn on if the temperature was 2.5°C? Explain how you know.
- 6 Suppose the heater turns on when the temperature is at 15°C or below. Write an inequality for this new situation. Graph the solution on the number line below.



Explain when to use an open or closed circle when graphing an inequality.

Trv It

Use what you just learned about graphing inequalities to solve this problem.

8 This graph shows the solution of what inequality? ______





Read the problem below. Then explore how to write and solve an inequality.

Cooper spent at least \$25 at a music concert. What are some possible amounts of money Cooper could have spent? Write an inequality to represent the amount of money Cooper spent, and graph the solution on a number line.

Model It

You can use words and symbols to represent this problem.

The amount Cooper spent, x, is greater than or equal to \$25.

$$x \ge 25$$

Another way to think about this problem is that \$25 is less than or equal to the amount Cooper spent, so $25 \le x$.

Model It

You can graph the inequality on a number line to solve the problem.



Q Check It

You can substitute values for x to check your solution.

The graph shows that \$25.50 is a possible solution. You can replace x with 25.5 to check.

$$x \ge 25$$

$$25.5 \ge 25$$
 TRUE

The graph shows that \$30 is a possible solution. You can replace x with 30 to check.

$$25 \le x$$

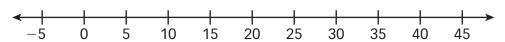
$$25 \le 30$$
 TRUE



Connect It

Now you will solve the problem using the model and graph.

- 9 Explain how $x \ge 25$ and $25 \le x$ both represent the amount Cooper spent at the concert.
- 10 Look at the graph of $x \ge 25$. What does the closed circle at 25 mean?
- 111 What is a possible amount of money Cooper could have spent? Check your solution.
- 12 How would the inequality be different if the problem said that Cooper spent more than \$25? Write and graph the inequality on the number line below.



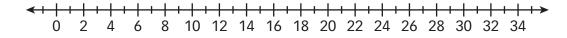
13 Explain how a shaded line means that fractions, decimals, and numbers not labeled on a number line can be part of the solution to an inequality.

N Try It

Use what you just learned about writing and graphing inequalities to solve this problem.

Some sources say that Earth's atmosphere does not exist above $30\frac{1}{2}$ km. Write an inequality to represent where the atmosphere exists.

Now graph the solution on the number line below.



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The student replaced the variable, x, with a value to see if the inequality was true.



Pair/Share

How could you justify your answer by graphing the solution on a number line?

When you replace the x with each value, does that value make the inequality true or false?



Pair/Share

How is this problem similar to and different from the student model?

Study the student model below. Then solve problems 15-17.

Student Model

Which of the following values is not a solution of x - 4 < 15?

$$0, 19, 18.9, 15\frac{1}{4}$$

Look at how you can show your work using a model.

$$15\frac{1}{4} - 4 < 15$$
 $11\frac{1}{4} < 15$ TRUE

Solution: 19 is not a solution of x - 4 < 15.

15 Which of the following values is a solution of 12.6 \leq 3x?

Show your work.

Solution: ___



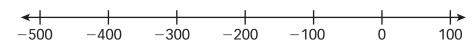
Algae cannot survive at depths greater than 300 meters below sea level. The inequality that represents depths at which algae cannot survive is x < -300. Graph the solution on a number line.

Show your work.

Will your graph have an open or a closed circle?



Solution:



Which inequality represents the situation: Hailey has at most \$500 in her bank account?

A x > 500

B $x \ge 500$

C x < 500

D $x \le 500$

Tessa chose **C** as the correct answer. How did she get that answer?

Pair/Share

How could you use substitution to check your graph?

Does "at most 500" include 500 as a possible solution?



Pair/Share

What are some words that help you know when to use < and when to use ≤?

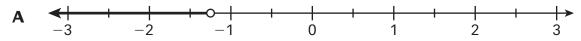
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False



Solve the problems.

1 Which is a correct graph of $x \le -1\frac{1}{4}$?





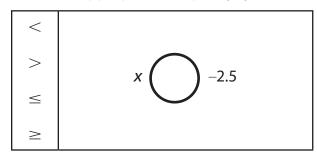
- Mark cannot read traffic signs that are more than 50 meters away. Which inequality represents distances at which Mark cannot read signs?
 - **A** x > 50
 - **B** $x \ge 50$
 - **C** x < 50
 - **D** $x \le 50$
- **3** Look at the inequality $5x + 1 \ge 35$. Choose True or False for each statement.
 - A 100 is not a solution because it is much greater than 35.
 - **B** 7.04 cannot be a solution because only whole numbers can be solutions.
 - **C** $6\frac{4}{5}$ is not a solution because the expression on the left side cannot equal 35.
 - **D** There are an infinite number of solutions. ☐ True ☐ False
 - **E** 34 is not a solution because it is less than 35.



4 Which inequality does this graph represent?



Insert the appropriate inequality symbol to complete the statement.



5 Eric has practiced more than 40 hours with his band.

Write an inequality to express this situation. _

On the graph below, graph Eric's situation.



- **6** Judah's family wants to ride the bumper boats at a water park.
 - There are 4 children (c) and 2 adults (a) in Judah's family.
 - The boats are safe if $40c + 120a \le 500$.

Can Judah's family ride the bumper boats safely? Explain.

Show your work.

Answer



Self Check Go back and see what you can check off on the Self Check on page 143.